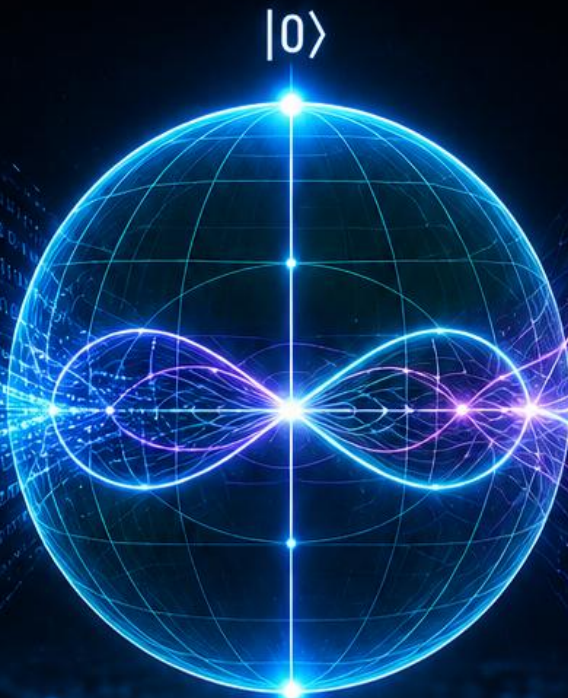


QUANTUM PHYSICS

CHEAT SHEET

KEY CONCEPTS. CORE EQUATIONS. REAL-WORLD APPLICATIONS.
QUANTUM COMPUTING. ENTANGLEMENT. BEYOND THE CLASSICAL.



TELEPORTATION



ENCRYPTION



QUANTUM COMPUTING

CHRISTOPHER CAMPBELL

1. Wave-Particle Duality

- Particles (like electrons and photons) behave both as waves and particles.
- Double-Slit Experiment: Light creates an interference pattern (wave behavior) unless observed (particle behavior).

2. Schrödinger's Cat & Superposition

- A system (like an atom or a cat) can exist in multiple states at once until measured.
- The act of observation collapses the wave function, forcing a definite state.

3. The Uncertainty Principle (Heisenberg's Rule)

- We can't know both the position and momentum of a particle with absolute precision.
- The more accurately we measure one, the more uncertain the other becomes.

4. Quantum Entanglement

- Two particles can become "linked" so that measuring one instantly affects the other, no matter how far apart they are.
- Einstein called it "spooky action at a distance."

5. The Observer Effect

- The act of measurement changes the outcome of a quantum system.
- Observing a quantum particle forces it into a definite state.

6. Quantum Tunneling

- Particles can pass through barriers they shouldn't be able to, as if "teleporting" through solid objects.
- Used in modern electronics (semiconductors, transistors, and quantum computing).

7. Quantum Computing (Qubits vs. Classical Bits)

- Classical bits: Store info as 0 or 1.
- Quantum bits (qubits): Can be 0, 1, or both at the same time (superposition)—making quantum computers exponentially faster.

8. The Future of Quantum Physics

- Quantum teleportation, ultra-secure quantum encryption, and faster-than-light communication could soon become reality.
- Quantum mechanics is already shaping AI, medicine, and futuristic tech.